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ABSTRACT

The Department of Housing and Urban Development (HUD), in its efforts to provide decent housing and a suitable living environment, is concerned with noise as a major source of environmental pollution. To this end, these guidelines are presented to provide site screening techniques. The procedures described have been developed so that people without technical training will be able to assess the exposure of a housing site to present and future noise conditions. Assessment is designed as an evaluation of the site's exposure to three major sources of noise--aircraft, roadways, and railways. Information needed to make the assessment is listed at the beginning of each section under headings which indicate the most likely source from which to obtain the information. Evaluation of the site exposure is given in terms of acceptability categories: clearly acceptable, normally acceptable, normally unacceptable, and clearly unacceptable. Final evaluation is determined according to the least favorable category found for any of the individual source evaluations. A fourth, optional evaluation technique, a Walk-Away Test, is described as useful when previous evaluations leave doubt as to the site's acceptability. Additional items included in these guidelines are evaluation worksheets and charts for calculating data. (BL)

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HUD

noise assessment guidelines

U.S. Department of Housing and Urban Development
Washington, D.C. 20410

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Preface

The Department of Housing and Urban Development, in its efforts to provide decent housing and a suitable living environment, is concerned with noise as a major source of environmental pollution and has issued the Departmental Circular 1390.2 on Noise Abatement and Control.

In furtherance of Section 4a of the Circular, the Office of Research and Technology has sponsored research to provide site screening techniques. These Noise Assessment Guidelines do not constitute established policy of the Department. Their use as a site "screening tool" is encouraged so that HUD may evaluate their utility.

This booklet has been prepared by Bolt Beranek and Newman Inc. under Contract No. H-1498 for the U.S. Department of Housing and Urban Development.

The authors wish to thank Mr. George E. Winzer, Chief, Urban Noise Abatement Research Program, Office of Research and Technology, U.S. Department of Housing and Urban Development, for his technical assistance and untiring support during the course of this project.

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Introduction

These guidelines are presented as part of a continuing effort by the Department of Housing and Urban Development to provide decent housing and a suitable living environment for all Americans.

The procedures described here have been developed so that people without technical training will be able to assess the exposure of a housing site to present and future noise conditions. The only materials required are a map of the area, a ruler (straight edge), a pencil, and perhaps a 100-ft tape measure. Tear-out worksheets and working figures are contained in the back of this booklet.

All of the information you will need can be obtained from public agencies – usually by telephone. For convenience, this information is listed at the beginning of each section under headings which indicate the most likely source. While you are obtaining this information, be sure to ask about any approved plans that may affect noise levels at the site – for example, land-use changes, changes in runway traffic, widening of roads, and so forth. In all evaluations, you should try to assess for the situation that will have the most lasting effect on the site.

The assessment is presented as an evaluation of the site's exposure to three major sources of noise – Aircraft, Roadways, and Railways. The evaluation is given in terms of the following acceptability categories:

Clearly Acceptable –

the noise exposure is such that both the indoor and outdoor environments are pleasant.

Normally Acceptable –

the noise exposure is great enough to be of some concern but common building constructions will make the indoor environment acceptable, even for sleeping quarters, and the outdoor environment will be reasonably pleasant for recreation and play.

Normally Unacceptable –

the noise exposure is significantly more severe so that unusual and costly building constructions are necessary to ensure some tranquillity indoors, and barriers must be erected between the site and prominent noise sources to make the outdoor environment tolerable.

Clearly Unacceptable –

the noise exposure at the site is so severe that the construction costs to make the indoor environment acceptable would be prohibitive and the outdoor environment would still be intolerable.

The site's exposure to noise from each of these sources is evaluated according to the least favorable category found for that source. For example, if the assessment shows that the exposure to noise from three different roads is Clearly Acceptable, Normally Acceptable, and Clearly Unacceptable, then the site's exposure to roadway noise is Clearly Unacceptable. Similarly, if the site's exposure to roadway and railway noise is Normally Acceptable but its exposure to aircraft noise is Normally Unacceptable, then the final site evaluation is Normally Unacceptable (see Worksheet A).

Another technique for assessing the noise levels at a housing site is a simple procedure called the Walk-Away Test. This evaluation, which is described in the fourth section of this booklet, is optional. It may be performed during a visit to the site or when the evaluations in the first three sections leave some doubt as to the site's acceptability.

When measuring the distance from the site to any source, you should measure from the location of the dwelling nearest the source because this is the housing that will be most severely affected by the noise. If at any point during the assessment the site's exposure to noise is found Normally or Clearly Unacceptable, then there is no need to continue the evaluations unless the location of the dwellings can be changed or some shielding can be provided to block the noise from that source.

Aircraft

To evaluate a site's exposure to aircraft noise, you will need to consider all airports (commercial and military) within 15 miles of the site. The information required for this evaluation is listed below under headings that indicate the most likely source. Before beginning the evaluation, you should record the following information on Worksheet B –

From the FAA Area Office or the Military Agency in charge of the airport:

Are NEF (Noise Exposure Forecast) or CNR (Composite Noise Rating) contours available? (These contours have not yet been constructed for all airports. When available, they are superimposed on a map with a marked scale.)

Any available information about approved plans for runway changes (extensions or new runways).

From the FAA Control Tower or Airport Operator (if NEF or CNR contours are not available):

The number of nighttime jet operations (10:00 p.m. – 7:00 a.m.).

The number of daytime jet operations (7:00 a.m. – 10:00 p.m.).

Are there any supersonic jet operations?

The flight paths of the major runways.

Any available information about expected changes in airport traffic – e.g., will the number of operations increase or decrease in the next ten or fifteen years? Are there any plans for supersonic jet traffic?

In making your evaluation, use the data for the heaviest traffic condition, whether present or future.

If NEF or CNR contours are available, locate the site by referring to the marked scale. Also locate a point roughly in the center of the area covered by the principal runways. If the site lies outside the NEF-30 (CNR-100) contour, then draw a straight line to connect these two points. Measure along this line the distances between (1) the NEF-40 (CNR-115) and NEF-30 (CNR-100) contours and (2) the NEF-30 (CNR-100) contour and the site. Now use Table I to evaluate the site's exposure to aircraft noise.

If NEF or CNR contours are not available, determine the effective number of operations for the airport as follows. Multiply the number of nighttime jet operations by 17. Then add the number of daytime jet operations to obtain an effective total. Any supersonic jet operation automatically places an airport in the largest category of Table II, which governs noise acceptability (see procedure, next page). [Examples are given in italics in the right-hand columns.]

Example 1: The illustration at the top of page 5 shows two sites located on a map that has NEF contours. We draw a line from each of these sites to a point roughly in the center of the area covered by the principal runways.

Measuring along these lines, we find that Site #1 lies outside the NEF-30 contour at a distance greater than that between the NEF-30 and NEF-40 contours and that Site #2 lies outside the NEF-30 contour at a distance less than that between the NEF-30 and NEF-40 contours.

Therefore, the exposure of Site #1 to aircraft noise is Clearly Acceptable and the exposure of Site #2 is Normally Acceptable.

Example 2: The illustration at the bottom of page 5 shows an airport for which NEF or CNR contours are not available. The airport has 20 nighttime and 125 daytime jet operations.

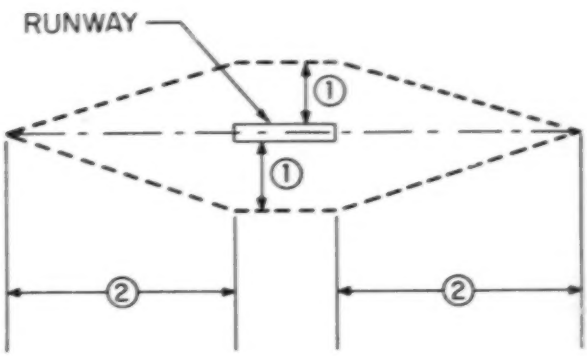
(Continued at top of next page.)

TABLE I.

SITE EXPOSURE TO AIRCRAFT NOISE

Distance from Site to the Center of the Area Covered by the Principal Runways	Acceptability Category
Outside the NEF-30 (CNR-100) contour, at a distance greater than or equal to the distance between the NEF-30 and NEF-40 (CNR-100, CNR-115) contours	Clearly Acceptable
Outside the NEF-30 (CNR-100) contour, at a distance less than the distance between the NEF-30 and NEF-40 (CNR-100, CNR-115) contours	Normally Acceptable
Between the NEF-30 and NEF-40 (CNR-100, CNR-115) contours	Normally Unacceptable
Within the NEF-40 (CNR-115) contour	Clearly Unacceptable

On a map of the area which shows the principal runways, mark the locations of the site and of the center of the area covered by the principal runways. Then, using the distances below, you can construct approximate NEF-40 and NEF-30 contours for the major runways and flight paths most likely to affect the site. Again use Table I to evaluate the site's exposure to aircraft noise.



Construction of Approximate NEF Contours Using the Distances in Table II.

Example 2 (continued)
There are no supersonic flights and so we determine the effective number of operations as follows:

20 (nighttime) × 17 = 340

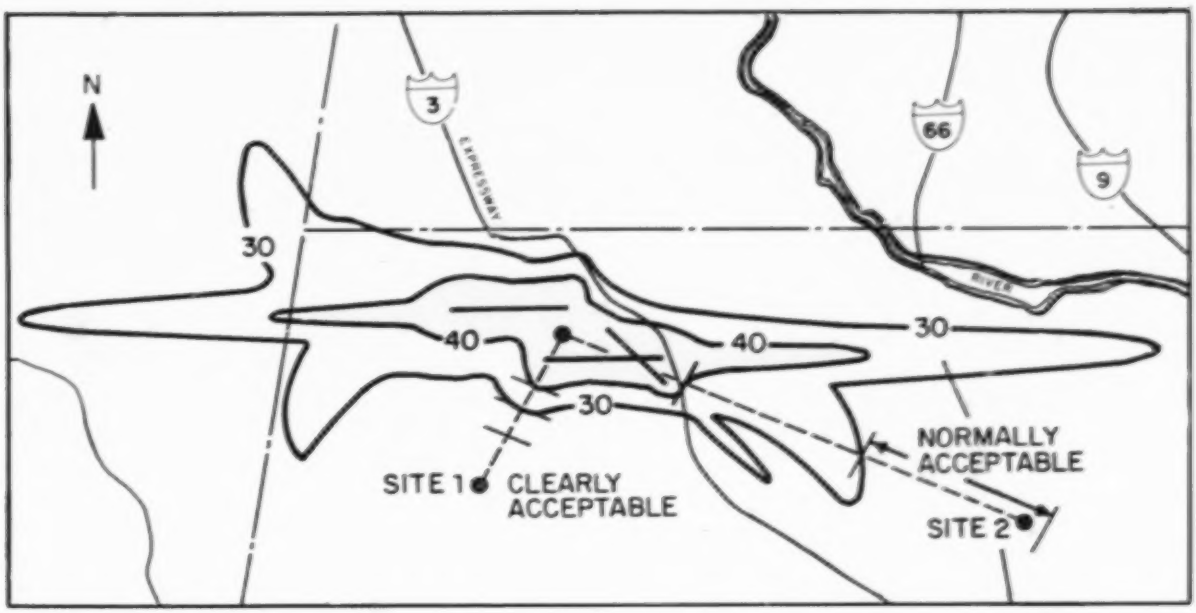
Add to this the actual number of daytime operations:
340 + 125 (daytime) = 465

Using the distances in Table II, we construct approximate NEF contours and then draw a line from the site to a point roughly in the center of the area covered by the principal runways. Measuring along this line, we find that the site lies outside the NEF-30 contour at a distance greater than that between the NEF-30 and NEF-40 contours. Therefore, the site's exposure to aircraft noise is Clearly Acceptable.

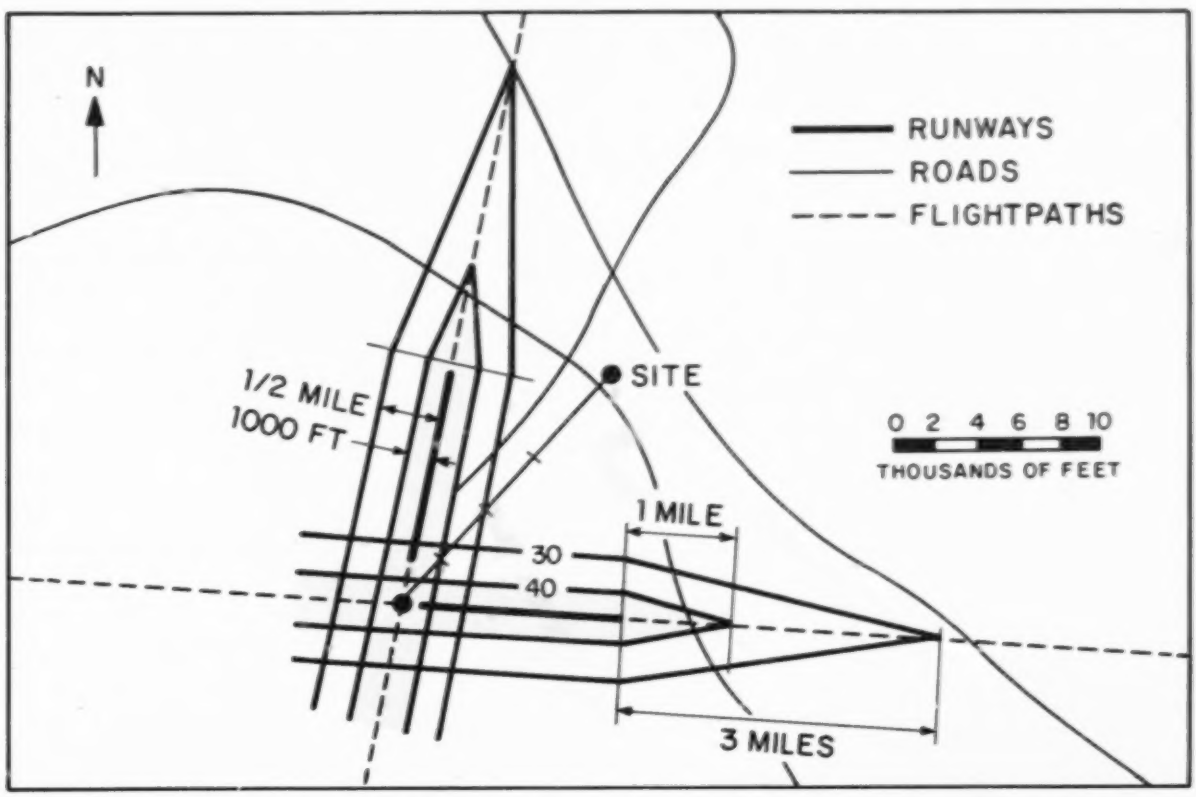
TABLE II.

DISTANCES FOR APPROXIMATE NEF CONTOURS

Effective Number of Operations	Distances to NEF 30 Contour		Distances to NEF 40 Contour	
	①	②	①	②
0 – 50	1000 ft	1 mile	0	0
51 – 500	1/2 mile	3 miles	1000 ft	1 mile
501 – 1300	1 1/2 miles	6 miles	2000 ft	2 1/2 miles
More than 1300 or any supersonic jet operations	2 miles	10 miles	3000 ft	4 miles



Example of NEF Contours



Example of Approximate NEF Contours Drawn for An Airport With An Effective Number of Operations Between 51 and 500.

Roadways

NECESSARY INFORMATION

To evaluate a site's exposure to roadway noise, you will need to consider all major roads within 1000 ft of the site. The information required for this evaluation is listed below under headings that indicate the most likely source. Before beginning the evaluation, you should try to obtain any available information about approved plans for roadway changes (e.g., widening existing roads or building new roads) and about expected changes in road traffic (e.g., will the traffic on this road increase significantly in the next ten or fifteen years?). Then, record the following information on Worksheet C –

From an area map and/or the City (County) Engineer:

The distances from the site to the center-lines of the nearest and farthest lanes of traffic.

From the City (County) Director of Traffic:

The peak hourly automobile traffic flow in both directions, combined.

The peak number of trucks (buses)* per hour in each direction. (If the road has a gradient of 3% or more, record uphill and downhill numbers separately as these figures will be necessary later; if not, simply record the total number of trucks.)

Note: you may also need to make adjustments for the following circumstances:

- A road gradient of 3% or more
- Stop-and-go Traffic
- Mean Speed
- A Barrier

The information required for these adjustments can be obtained from the City (County) Director of Traffic.

*Buses count as trucks

Traffic surveys show that the level of roadway noise depends on the percentage of trucks in the total traffic volume. To account for this effect, these guidelines provide for separate evaluation of automobile and truck traffic.

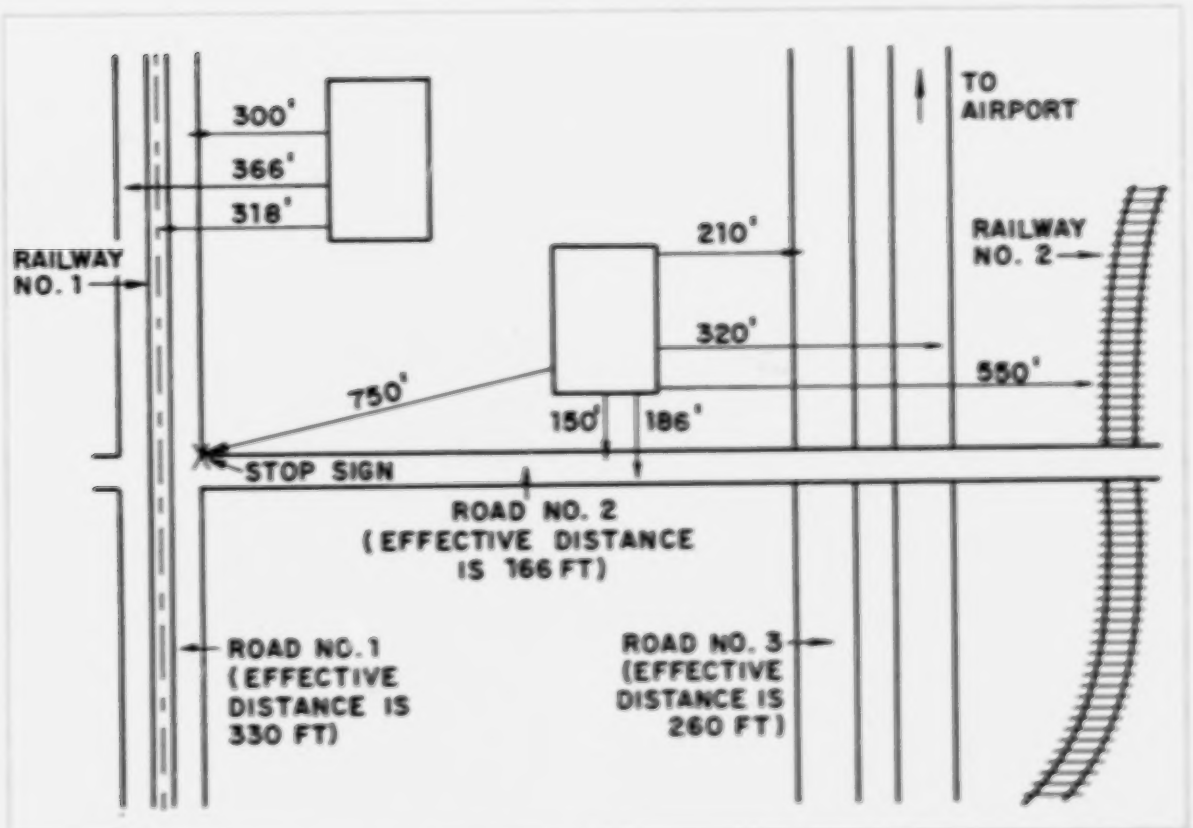
Before proceeding with these separate evaluations, however, determine the effective distance from the site to each road by locating on Figure 1 the distances from the site to the centerlines of the nearest and farthest lanes of traffic.

[Large-scale work-sheet figures are contained in pouch at the back of the book.]

Examples

The site shown below is exposed to noise from three major roads: Road #1 has four lanes, each 12 ft wide, and a 30-ft wide median strip which accomodates a rapid transit line. Road #2 has four lanes, each 12 ft wide. Road #3 has six lanes, each 15 ft wide, and a median strip 35 ft wide.

The distances shown below will be used for all roadway examples in this booklet.



Plan View of Site Showing How Distances Should be Measured From the Location of the Dwelling Nearest to the Source.

Effective Distance (cont'd):

Now lay a straight-edge to connect these two distances and read off the value at the point where the straight-edge crosses the middle scale. This value is the effective distance to the road and should be recorded on line 4.

Example 1: Road #1 – The distance from the site to the centerline of the nearest lane of traffic is 300 ft The distance to the centerline of the farthest lane of traffic is 366 ft. Figure 1 shows that the effective distance from the site to this road is 330 ft. Road #2 – The distance to the centerline of the nearest lane of traffic is 150 ft. The distance to the centerline of the farthest lane of traffic is 186 ft. Figure 1 shows that the effective distance from the site to this road is 166 ft. Road #3 – The distance to the centerline of the nearest lane of traffic is 210 ft. The distance to the centerline of the farthest lane of traffic is 320 ft. Figure 1 shows that the effective distance from the site to this road is 260 ft.

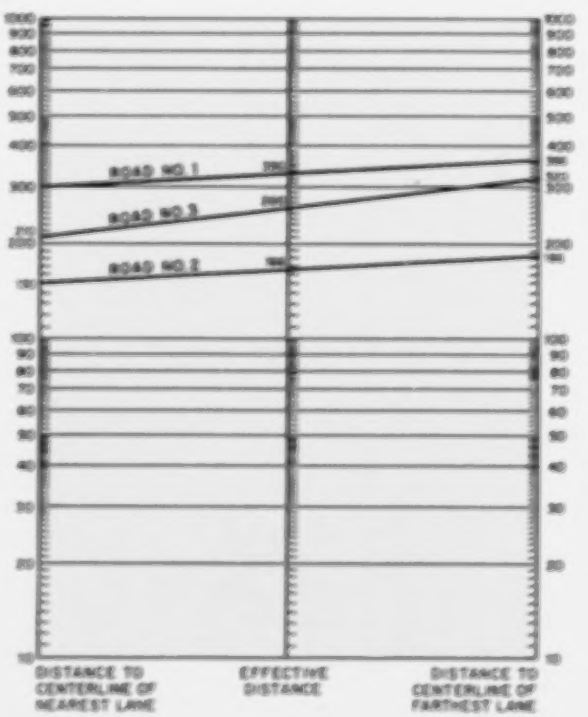
The numbers in Figure 2, which is used to evaluate the site's exposure to automobile noise, were arrived at with the following assumptions:

- There is no traffic signal or stop sign within 800 ft of the site.
- The mean automobile traffic speed is 60 mph.
- There is line-of-sight exposure from the site to the road – i.e., there is no barrier which effectively shields the site from the road.

If a road meets these three conditions, proceed to Figure 2 for an immediate evaluation of the site's exposure to the automobile noise from that road.

But

if any of these conditions are different, make the necessary adjustment(s) and <u>then</u> use Figure 2 for the evaluation.



Example of How Figure 1 is Used to Determine Effective Distances.

<u>Stop-and-go Traffic:</u>

If there is a traffic signal or stop sign within 800 ft of the site, multiply the total number of automobiles per hour by 0.1. Record your answer on line 5.

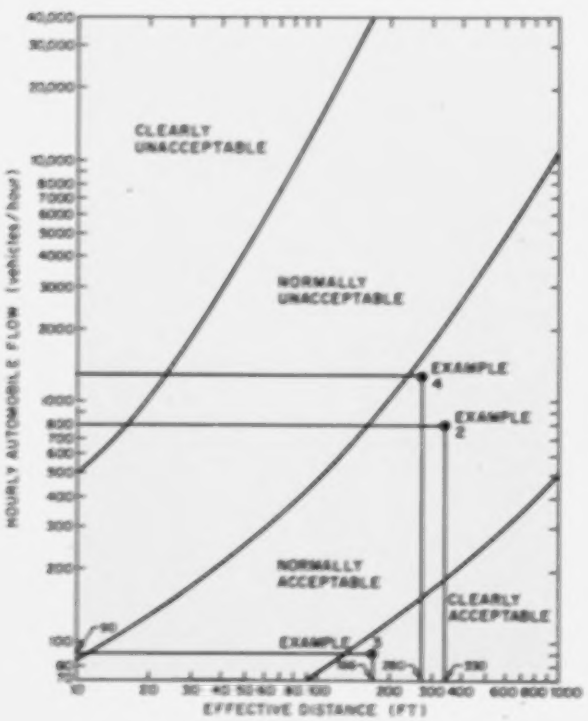
<u>Mean Traffic Speed</u>:

If there is no traffic signal or stop sign within 800 ft of the site <u>and</u> the mean automobile speed is other than 60 mph, multiply the total number of automobiles by the appropriate adjustment factor (top of next page). Record your answer on line 6.

Mean Traffic Speed	Adjustment Factor
20 (mph)	0.12
25	0.18
30	0.25
35	0.32
40	0.40
45	0.55
50	0.70
55	0.85
60	1.00
65	1.20
70	1.40

Barrier Adjustment:

This adjustment affects distance and applies equally to automobiles and trucks on the same road. Therefore, instructions for this adjustment appear after those for truck traffic.



Example of How Figure 2 is Used to Evaluate Site Exposure to Automobile Noise.

Example 2: Road #1 meets the three conditions that allow for an immediate evaluation. In obtaining the information necessary for this evaluation, we found that the hourly automobile flow is 800 vehicles. On Figure 2, we locate on the vertical scale the point representing 800 vehicles/hr and on the horizontal scale the point representing 330 ft. (Note that we must estimate the location of this point.) Using a straightedge, we draw lines to connect these two values and find that the site's exposure to automobile noise from this road is Normally Acceptable.

Example 3: Road #2 has a stop sign at 750 ft from the site. The hourly automobile flow is reported as being 900 vehicles. We adjust for stop-and-go traffic

$$900 \times 0.1 = 90 \text{ vehicles}$$

and find from Figure 2 that the exposure to automobile noise is Clearly Acceptable.

Example 4: Road #3 is a depressed highway. There is no traffic signal or stop sign and the mean speed is 60 mph. The hourly automobile flow is 1200 vehicles. The road profile shields all residential levels of the housing from line-of-sight to the traffic. The only adjustment that can be made is the barrier adjustment. This adjustment is necessary, however, only when the site's exposure to noise has been found Clearly or Normally Unacceptable. Figure 2 shows that the exposure to automobile noise is Normally Acceptable. Therefore, no adjustment for barrier is necessary.

The numbers in Figure 3, which is used to evaluate the site's exposure to truck noise, were arrived at with the following assumptions:

- There is a road gradient of less than 3 %.
- There is no traffic signal or stop sign within 800 ft of the site.
- The mean truck traffic speed is 30 mph.
- There is line-of-sight exposure from the site to the road – i.e., there is no barrier which effectively shields the site from the road.

If a road meets these four conditions, proceed to Figure 3 for an immediate evaluation of the site's exposure to truck noise from that road.

But

if any of the conditions are different, make the necessary adjustment(s) listed below and <u>then</u> use Figure 3 for the evaluation.

ADJUSTMENTS FOR TRUCK TRAFFIC

Road Gradient:

If there is a gradient of 3 % or more, multiply the number of trucks per hour in the uphill direction by the appropriate adjustment factor.

% of Gradient	Adjustment Factor
3-4 %	1.4
5-6 %	1.7
More than 6 %	2.5

Add to this adjusted figure the number of trucks per hour in the downhill direction and record your answer on line 7.

Example 5: Road #1 meets the four conditions that allow for an immediate evaluation. The hourly truck flow is 60 vehicles. Figure 3 shows that the site's exposure to truck noise from this road is Normally Acceptable.

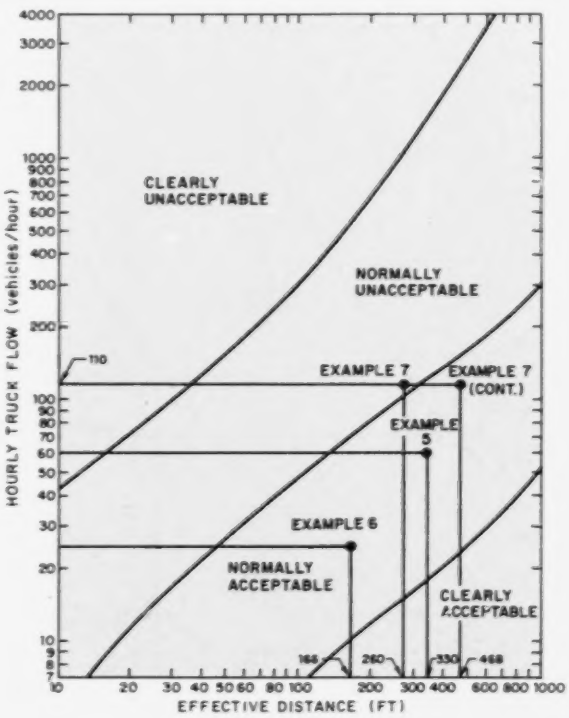
Example 6: Road #2 has a stop sign at 750 ft from the site. There is also a road gradient of 4%. No trucks are allowed on this road, but 4 buses per hour are scheduled – 2 in each direction.

We adjust first for gradient

uphill:	*2 × 1.4 = 2.8 vehicles*
downhill:	*2. vehicles*
total flow:	*4.8 vehicles*

And then adjust for stop-and-go traffic (see next page)

4.8 × 5 = 24 vehicles (per hour)



Example of How Figure 3 is Used to Evaluate the Site's Exposure to Truck Noise.

Stop-and-go Traffic:

If there is a traffic signal or stop sign within 800 ft of the site, multiply by 5 the total number of trucks. Record your answer on line 8. (If the truck traffic has already been adjusted for gradient, use the number on line 7; if not, use the number of trucks on line 3c for this calculation.)

Mean Traffic Speed:

Make this adjustment only if there is no traffic signal or stop sign within 800 ft of the site and the mean speed is not 30 mph.

If the mean truck speed differs with direction treat the uphill and downhill traffic separately. Multiply each by the appropriate adjustment factor below.

Add these two numbers and record your answer on line 9. (Remember that the uphill traffic may have been adjusted for road gradient.)

But

if the mean truck speed is the same for both directions, then multiply the total number of trucks (from either line 3c or line 7) by the appropriate adjustment factor. Record your answer on line 9.

Mean Traffic Speed (mph)	Adjustment Factor
20	1.60
25	1.20
30	1.00
35	0.88
40	0.75
45	0.69
50	0.63
55	0.57
60	0.50
65	0.46
70	0.43

Example 6 (continued)
Figure 3 shows that the exposure to truck (bus) noise from this road is Normally Acceptable.

Example 7: The profile of Road #3 shields all residential levels of the housing from line-of-sight to the traffic. The mean truck speed is 50 mph. The hourly truck flow is 175 vehicles. We adjust for mean speed

$$175 \times 0.63 = 110.25$$
$$= 110 \text{ vehicles}$$

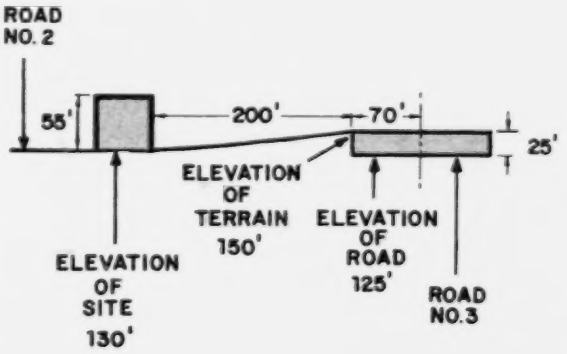
and find from Figure 3 that exposure to truck noise is Normally Unacceptable. Therefore, we proceed with the barrier adjustment (see next page).

Example 7 (cont): Road #3 has been depressed 25 ft from the 150 ft elevation of the natural terrain. The actual road elevation, therefore, is 125 ft. We find the effective road elevation to be

$$125 + 5 = 130 \text{ ft.}$$

Six stories are planned for the housing, which is located at an elevation of 130 ft. The effective site elevation for the highest story is:

$$6 \times 10 = 60 + 130 - 5 = 185 \text{ ft.}$$



Detail of Site Showing the Measurements Necessary for a Barrier Adjustment.

Barrier Adjustment:

Note: A barrier may be formed by the road profile, by a solid wall or embankment, by a continuous row of buildings, or by the terrain itself. To be an effective shield, however, the barrier must block all residential levels of all buildings from line-of-sight to the road, and it must not have any gaps that would allow noise to leak through.

This adjustment is necessary only when the site's exposure to noise from a road has been found Normally or Clearly Unacceptable.

To make the barrier adjustment, you should first record on line 10 the distance between the site and the barrier and on line 11 the distance between the center of the road and the barrier; then you should determine the differences in effective elevation between (1) the site and the road and (2) the barrier and the road as follows:

Step 1. From the City (County) Engineer, obtain the elevation of the road. (Roads may be elevated above the natural terrain or may be depressed, as in our example; make certain, therefore, that the figure you obtain for road elevation takes any such change into account.) Add 5 ft to this figure to obtain the effective road elevation and record your answer on line 12.

Step 2. From the applicant, obtain the ground elevation of the site and the number of stories in the proposed housing. Multiply the number of stories by 10 ft. Add the site elevation and then subtract 5 ft from this total to obtain the effective site elevation. Record your answer on line 13.

Step 3. From the City (County) Engineer or a contour map, obtain the elevation of the terrain where the barrier is located. Add the actual height of the barrier to obtain the effective barrier elevation. Record your answer on line 14. (Note that in some cases, as in our example, the barrier is formed by the road profile and the elevation of the terrain is the effective barrier elevation.)

Example 7 (continued)

The barrier, which is formed by the road profile, has no height other than the 150 ft elevation of the natural terrain. Thus, the effective barrier elevation is 150 ft.

The difference in effective elevation between (1) the site and the road is 55 ft and (2) the barrier and the road is 20 ft.

We now use Figure 4 to find the barrier adjustment factor.

Example of Barrier Adjustment

- *The distance from the site to the barrier is 200 ft.*
- *The distance from the center of the road to the barrier is 70 ft.*
- *The difference in effective elevation between the site and the road is 55 ft.*
- *The difference in effective elevation between the barrier and the road is 20 ft.*

On the vertical scale of Graph 1, we mark 200 ft and draw a straight horizontal line to meet the curve marked 70 ft. Then, we draw a vertical line down to Graph 2 to meet the point which represents 55 ft (note that we must guess the location) and a horizontal line over to Graph 3 to meet the curve marked 20 ft.

(Note: If the line from Graph 2 does not meet the appropriate curve on Graph 3, then the barrier is not an effective shield and there is no adjustment.)

Next, we draw a vertical line up to Graph 4 to meet the curve marked 4 (which is the number intersected by the line going from Graph 1 to Graph 2) and a horizontal line over to Graph 5 to meet the curve marked 200 ft. From Graph 5, we draw a vertical line down to the adjustment scale and find that our multiplier is 1.8.

Record the difference in effective elevation between the site (line 13) and the road (line 12) on line 15. Record the difference in effective elevation between the barrier (line 14) and the road (line 12) on line 16.

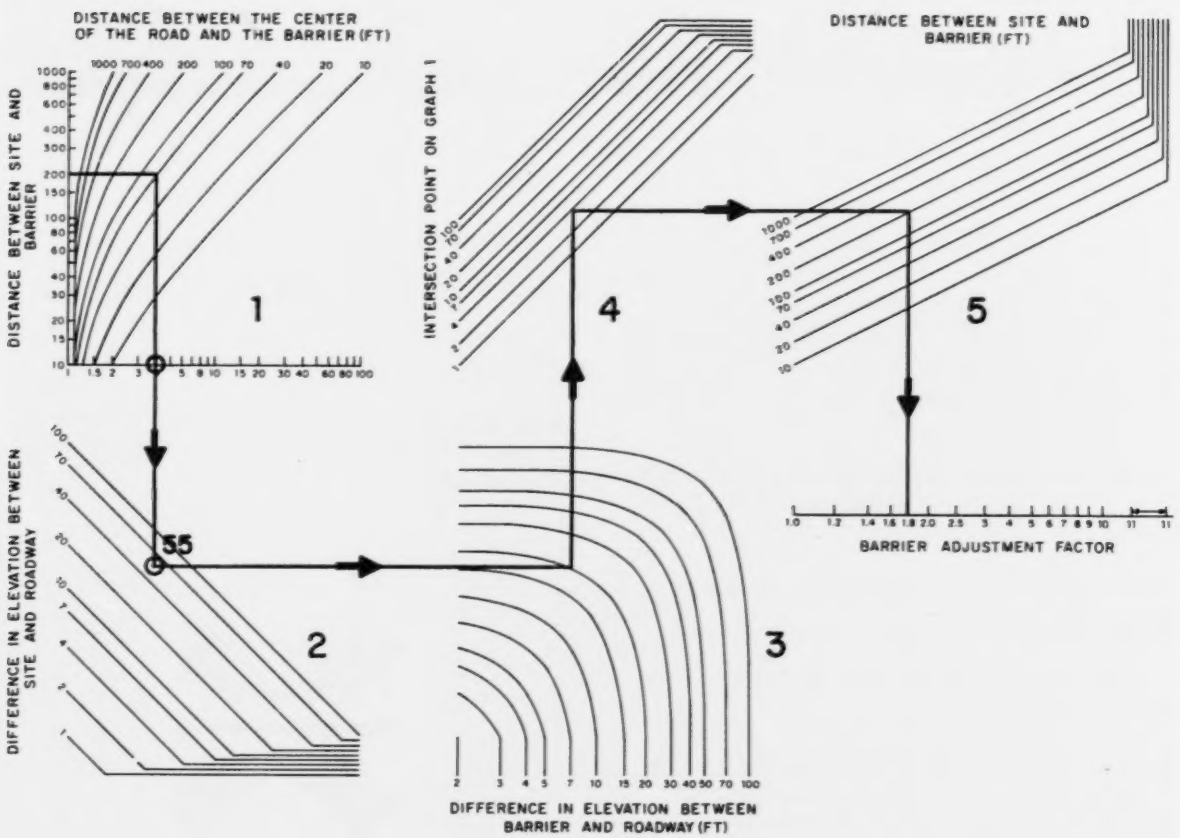
To find the barrier adjustment factor, you will need Figure 4, a straight edge, and the information recorded on lines 10, 11, 15, and 16. The Example of Barrier Adjustment explains how to use Figure 4.

When you have determined the barrier adjustment factor, multiply line 4, the effective distance, by the adjustment factor to obtain the adjusted distance from the site to the road. Record your answer on line 17.

Example 7 (continued)
Using this multiplier, we adjust the effective distance

260 × 1.8 = 468 ft

and find from Figure 3 that the site's exposure to truck noise from this road is Normally Acceptable.



Example of How Figure 4 is Used to Find the Adjustment Factor.

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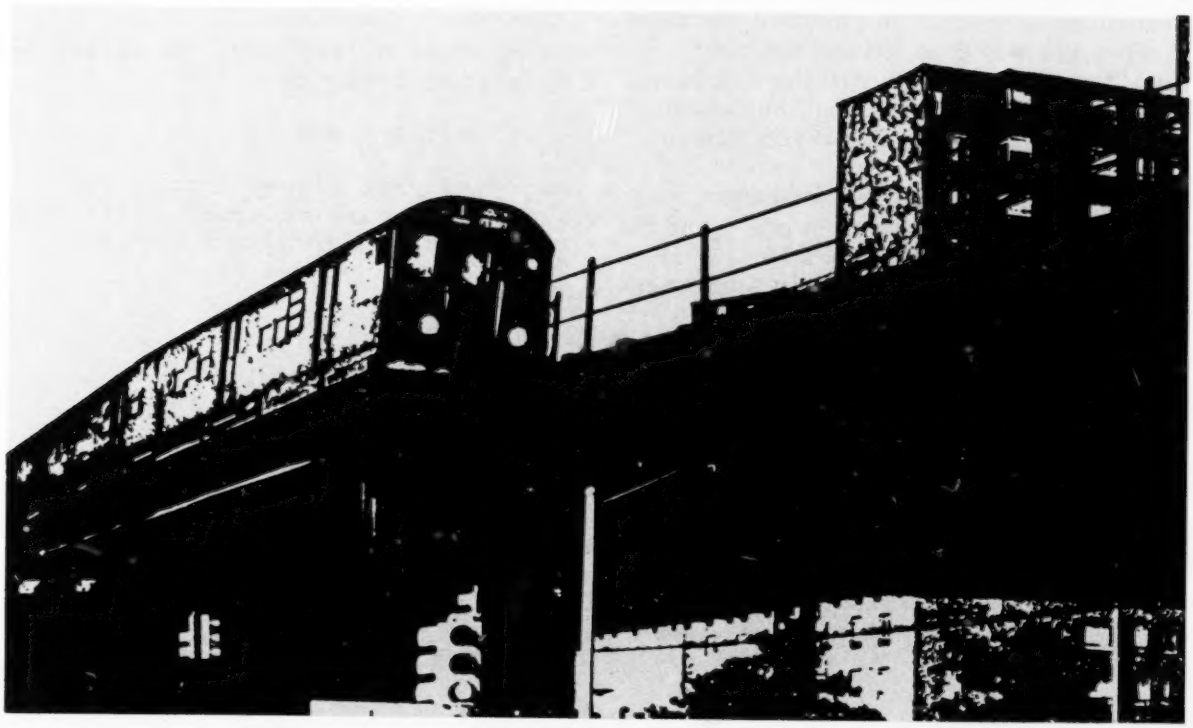
Railways



To evaluate a site's exposure to railway noise, you will need to consider all above-ground rapid transit lines and railroads within 3000 ft of the site. The information required for this evaluation is listed below under headings that indicate the most likely source.

Before beginning the evaluation, you should record the following information on Worksheet D –

From an area map and/or the (County) Engineer:

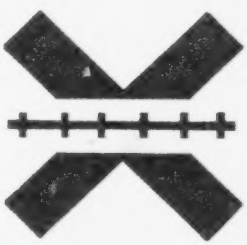
The distance from the site to the railway right-of-way.

Does a barrier effectively shield the site from the railway? (Remember that an effective barrier blocks all residential levels of all buildings from line-of-sight to the railway and has no gaps that would allow noise to leak through.)

From the Supervisor of Customer Relations for the railway:

The number of nighttime (10:00 p.m. – 7:00 a.m.) railway operations.

Any available information about approved plans for changing the number of nighttime operations.



The distances in Table III were arrived at with the assumption that there are 10 or more nighttime (10:00 p.m. – 7:00 a.m.) railway operations.

If a railway has 10 or more nighttime operations, proceed to Table III for an immediate evaluation of the site's exposure to noise from that railway.

But

if a railway has fewer than 10 nighttime operations, multiply the distance from the site to that railway by the appropriate adjustment factor; then proceed to Table III.

Number of Nighttime Railway Operations	Adjustment Factor
1 – 2 operations	3.3
3 – 5 operations	1.7
6 – 9 operations	1.2

Example 1: The distance from the site to Railway #1 is 318 ft. There are 2 nighttime operations and there is direct line-of-sight to the right-of-way. Since there are fewer than 10 nighttime operations, we adjust the distance as follows:

318 ft × 3.3 = 1049 ft

and then proceed to Table III where we find that the exposure to noise from this railway is Normally Acceptable.

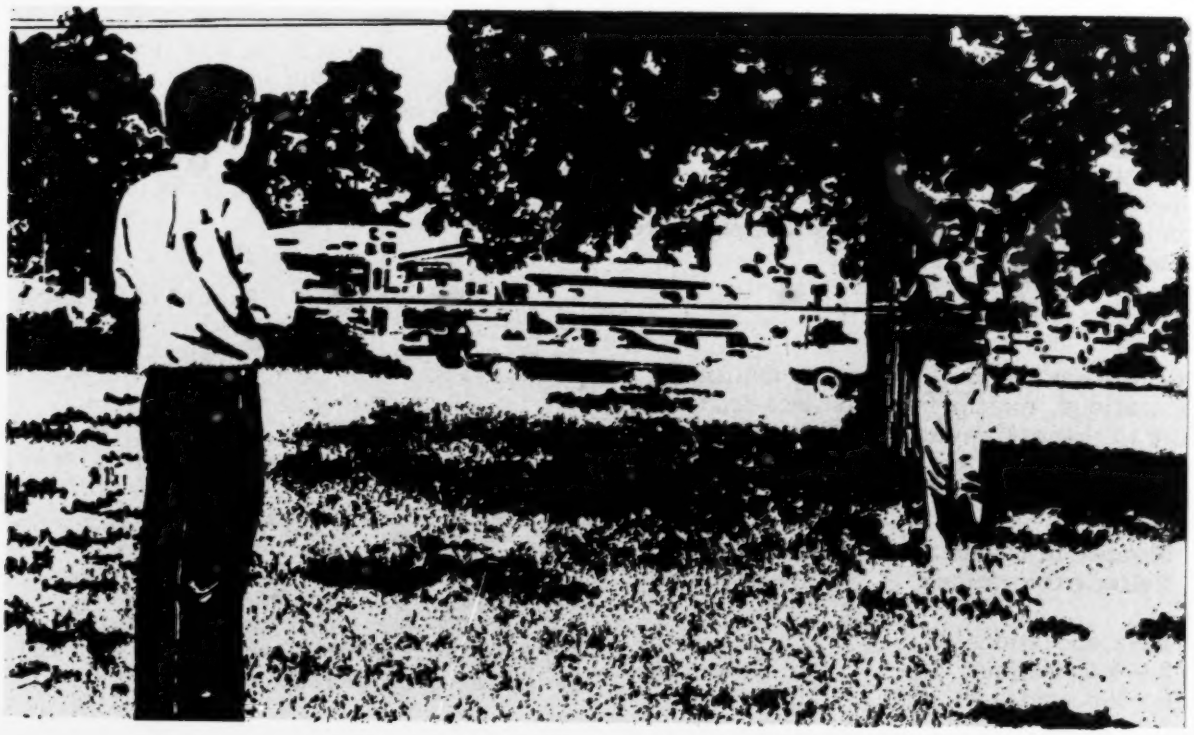
Example 2: The distance from the site to Railway #2 is 550 ft. There are 20 nighttime railway operations and the site is completely shielded from the right-of-way. Since there are more than 10 nighttime operations, we proceed immediately to Table III and find that the site's exposure to noise from this railway is Clearly Acceptable.

TABLE III.

SITE EXPOSURE TO RAILWAY NOISE

Distance from Site to Right-of-Way: (Possibly adjusted for number of nighttime operations)		Acceptability Category
Line-of-Sight Exposure	Shielded Exposure	
More than 3000 ft	More than 500 ft	Clearly Acceptable
Between 601 and 3000 ft	Between 101 and 500 ft	Normally Acceptable
Between 101 and 600 ft	Between 51 and 100 ft	Normally Unacceptable
Less than 100 ft	Less than 50 ft	Clearly Unacceptable

Walk–Away Test



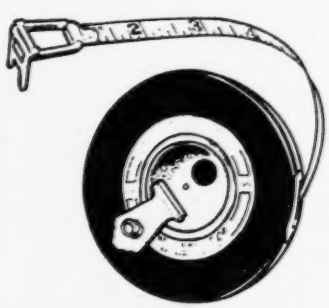
The Walk-Away Test is an optional evaluation that may be performed during any visit to the site. However, when the site's exposure to more than one source of noise is found Normally – rather than Clearly – Acceptable, the Walk-Away Test is strongly recommended as means of assessing the cumulative effects of noise from various sources.

The Walk-Away Test has been designed to evaluate – without reference to specific sources – the overall noise condition at a site. Since noise may vary during a 24-hour period, this test should be performed at those hours when noise is apt to be most severe – i.e., during the peak morning and afternoon traffic periods – and at those hours when noise is apt to be most annoying – i.e., between 10:00 p.m. and midnight when people are trying to go to sleep.

When performing a Walk-Away Test, you should record the following information on Worksheet E –

The date and time of the visit to the site.

The average of distances where understanding just becomes difficult.



The Walk-Away Test requires two men who exchange roles as speaker and listener; thus, each person should have normal hearing and an average voice. To perform the test, you will need a 100-ft tape measure and some reading material with which both persons are unfamiliar.

The speaker should stand at fixed location, while the listener, starting at a distance of 2 or 3 ft, backs slowly away. The speaker should hold the reading material at chest height in such a way as not to block the direct path from himself to the listener. He should not raise his voice in an attempt to maintain communication.

At some point the listener will find that he can understand only a scattered word or two over a period of 10 seconds or more. At this point, measure the distance between the listener and the speaker.

For consistent and accurate results, this procedure should be repeated several times during each visit and the distances should be averaged. Also, the roles of speaker and listener should be reversed to average out variations of normal speaking levels and hearing acuity. After each visit, evaluate the site's overall noise levels by using Table IV.

Example: The site's exposure to both roadway and railway noise has been evaluated as Normally Acceptable. Therefore, we assess the overall noise levels during three separate weekday visits to the site. During Visit #1, made between 8:00 and 9:00 a.m., the distances where understanding just became difficult were 50 ft, 55 ft, and 54 ft for an average of 53 ft. The average of distances for Visit #2, made between 4:00 and 5:00 p.m., was 47 ft and for Visit #3, made between 10:00 and 11:00 p.m., was 68 ft.

Table IV shows that during each visit, the overall noise level at the site was Normally Acceptable.

TABLE IV.

SITE EXPOSURE TO OVERALL NOISE LEVELS

Distance Where Understanding Becomes Very Difficult	Acceptability Category
More than 70 ft	Clearly Acceptable
26 – 70 ft	Normally Acceptable
7 – 25 ft	Normally Unacceptable
Less than 7 ft	Clearly Unacceptable

Final Evaluation

When you have completed the evaluations of the noise from aircraft, roadways and railways, enter these results on Worksheet A – Site Evaluation, and determine the final evaluation according to the least favorable category found for any of the individual source evaluations.

Notes

This space is provided for any notes you may wish to make during the evaluation.

WORKSHEET A – Site Evaluation

Site Location: _____

Program _____

Project Name _____ ____

Locality _____

File Number _____

Sponsor's Name _____

Street Address _____

City, State _____

Phone _____

Least Favorable Category found for

1. Aircraft Noise _____
2. Roadway Noise _____
3. Railway Noise _____
4. Walk-Away Test (if conducted) _____

Final Site Evaluation – Least Favorable Category Above:

_____

Clip this worksheet to the top of a package containing Worksheets B – E and Figs. 1-4.

Date: _____

Signature: _____

WORKSHEET B – Aircraft Noise

List all airports within 15 miles of the site:

Acceptability Category:

1. _____ _____
2. _____ _____
3. _____ _____

Necessary Information:

	Airport #1	Airport #2	Airport #3
1. Are NEF or CNR contours available? (yes/no)	_____	_____	_____
2. Number of nighttime jet operations:	_____	_____	_____
3. Number of daytime jet operations:	_____	_____	_____
4. Any supersonic jet operations? (yes/no)	_____	_____	_____

Date: _____

Signature: _____

Worksheet C – Roadway Noise

List all major roads within 1000 ft of the site:	Acceptability Category: Automobiles	Trucks
1. _____	_____	_____
2. _____	_____	_____
3. _____	_____	_____
4. _____	_____	_____

Necessary Information:

	Road #1	Road #2	Road #3	Road #4
1. The distance in feet from the site to the centerline of				
a. nearest lane:	_____	_____	_____	_____
b. farthest lane:	_____	_____	_____	_____
2. The total number of automobiles per hour in both directions:	_____	_____	_____	_____
3. The number of trucks per hour				
a. uphill direction:	_____	_____	_____	_____
b. downhill direction:	_____	_____	_____	_____
c. both directions:	_____	_____	_____	_____
4. Effective distance from site to road:	_____	_____	_____	_____
Adjustments for Automobile Traffic				
5. Stop-and-go:	_____	_____	_____	_____
6. Mean speed:	_____	_____	_____	_____
Adjustments for Truck Traffic				
7. Road gradient:	_____	_____	_____	_____
8. Stop-and-go:	_____	_____	_____	_____
9. Mean speed:	_____	_____	_____	_____
Barrier Adjustment				
10. Distance from site to barrier:	_____	_____	_____	_____
11. Distance from center of road to barrier:	_____	_____	_____	_____
12. Effective elevation of road:	_____	_____	_____	_____
13. Effective elevation of site: _____	_____	_____	_____	_____
14. Effective elevation of barrier:	_____	_____	_____	_____
15. Difference in elevation between site and road:	_____	_____	_____	_____

(Over)

Worksheet C – (Continued)

	Road #1	Road #2	Road #3	Road #4
16. Difference in elevation between barrier and road:	_____	_____	_____	_____
17. Adjusted distance:	_____	_____	_____	_____

Date: _____

Signature: _____

WORKSHEET D – Railway Noise

List all railways within 3000 ft of the site:

Acceptability Category:

1. _____ _____
2. _____ _____
3. _____ _____

Necessary Information:

	Railway #1	Railway #2	Railway #3
1. Distance in feet from the site to the railway right-of-way:	_____	_____	_____
2. Type of exposure (line-of-sight or shielded):	_____	_____	_____
3. Number of nighttime operations:	_____	_____	_____

Date: _____

Signature: _____

WORKSHEET E – Walk-Away Test

Date and time of each visit to the site:

1. _____
2. _____
3. _____

Acceptability Category:

_____
_____
_____

	Visit #1	Visit #2	Visit #3
Average of distances:	_____	_____	_____

Date: _____

Signature: _____

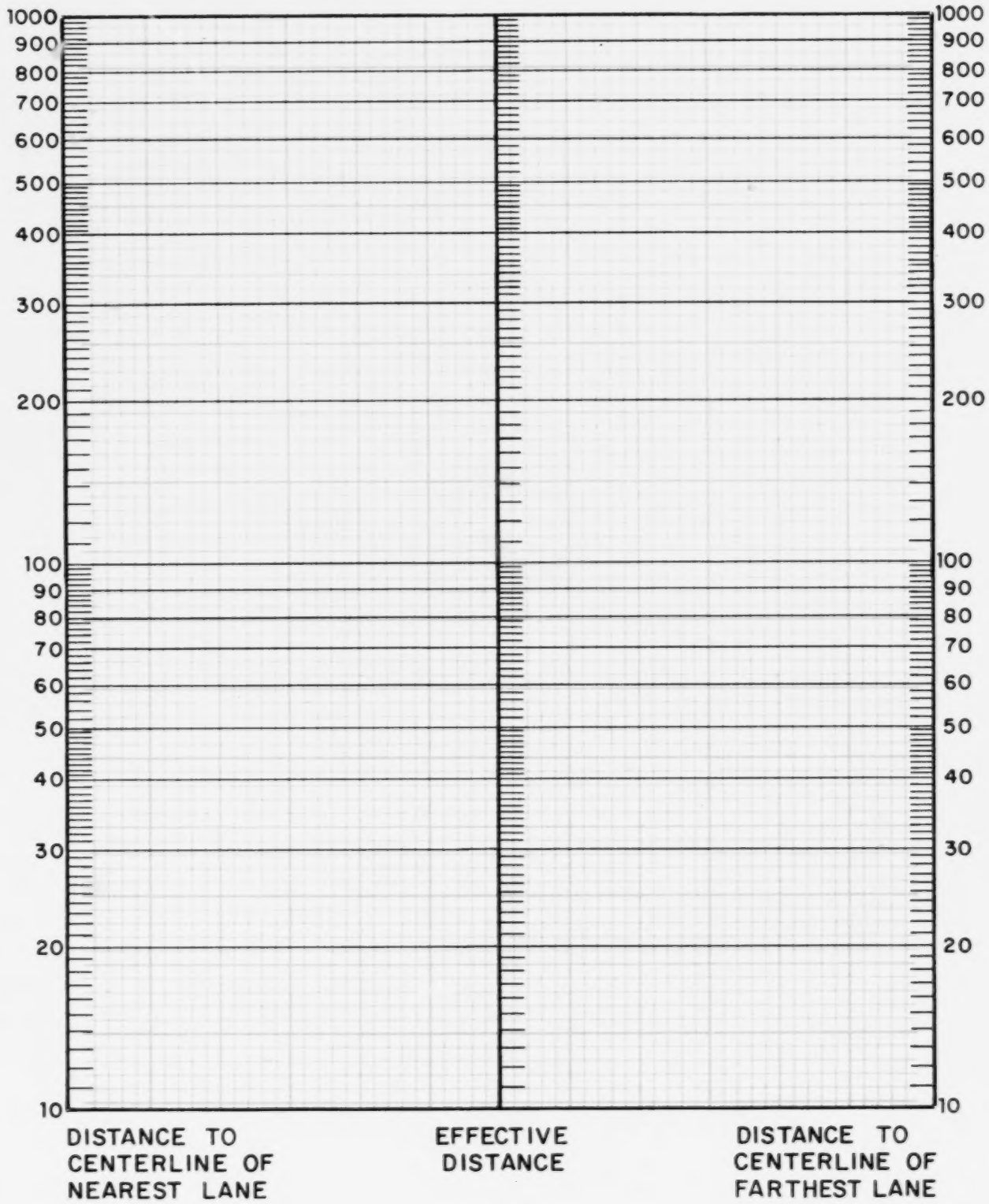

1000
900
800
700
600
500
400
300
200
100
90
80
70
60
50
40
30
20
10
DISTANCE TO CENTERLINE OF NEAREST LANE
EFFECTIVE DISTANCE
DISTANCE TO CENTERLINE OF FARTHEST LANE

Figure 1.

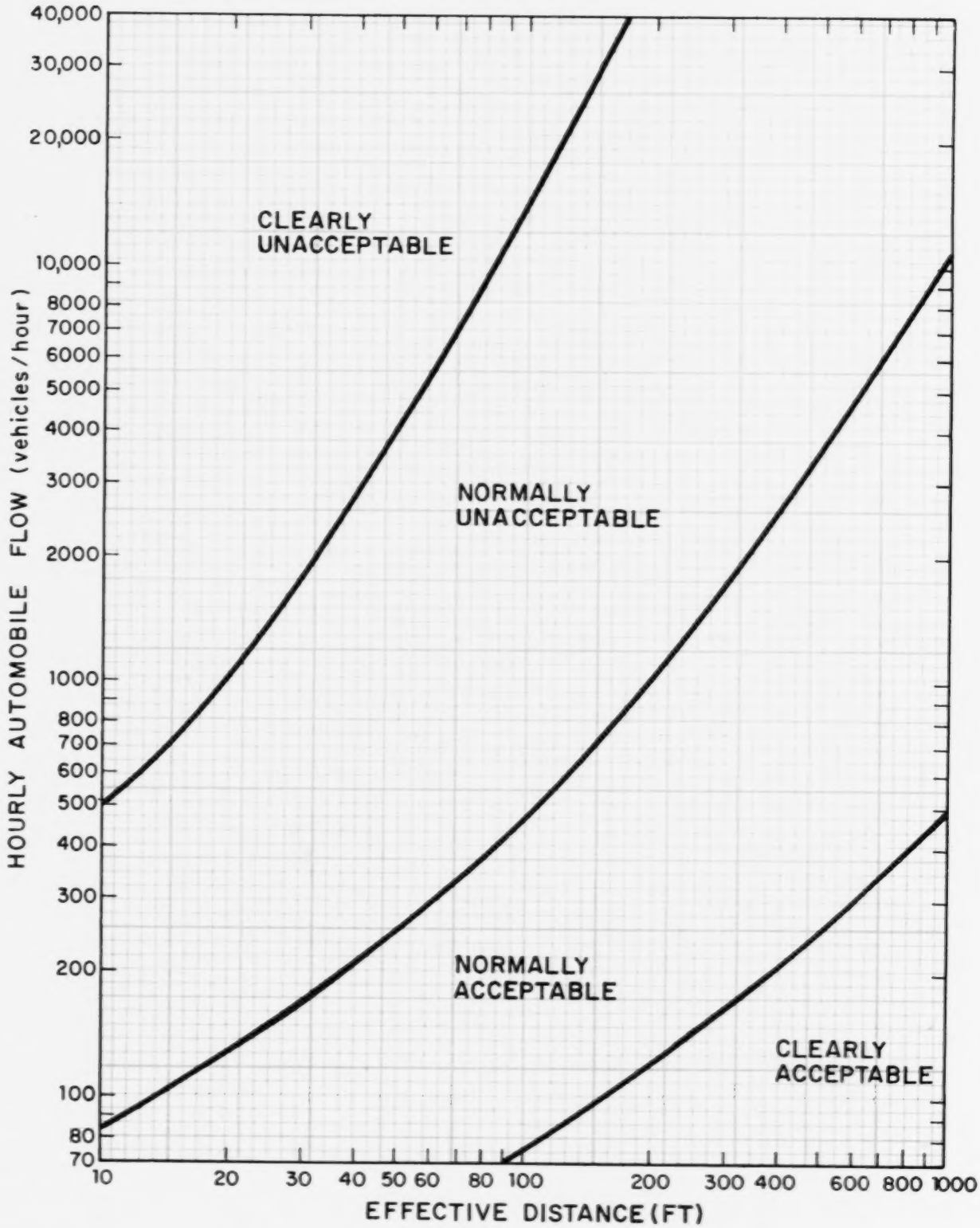

40,000
30,000
20,000
10,000
8000
7000
6000
5000
4000
3000
2000
1000
800
700
600
500
400
300
200
100
80
70
HOURLY AUTOMOBILE FLOW (vehicles/hour)
CLEARLY UNACCEPTABLE
NORMALLY UNACCEPTABLE
NORMALLY ACCEPTABLE
CLEARLY ACCEPTABLE
10
20
30
40
50
60
80
100
200
300
400
600
800
1000
EFFECTIVE DISTANCE (FT)

Figure 2.

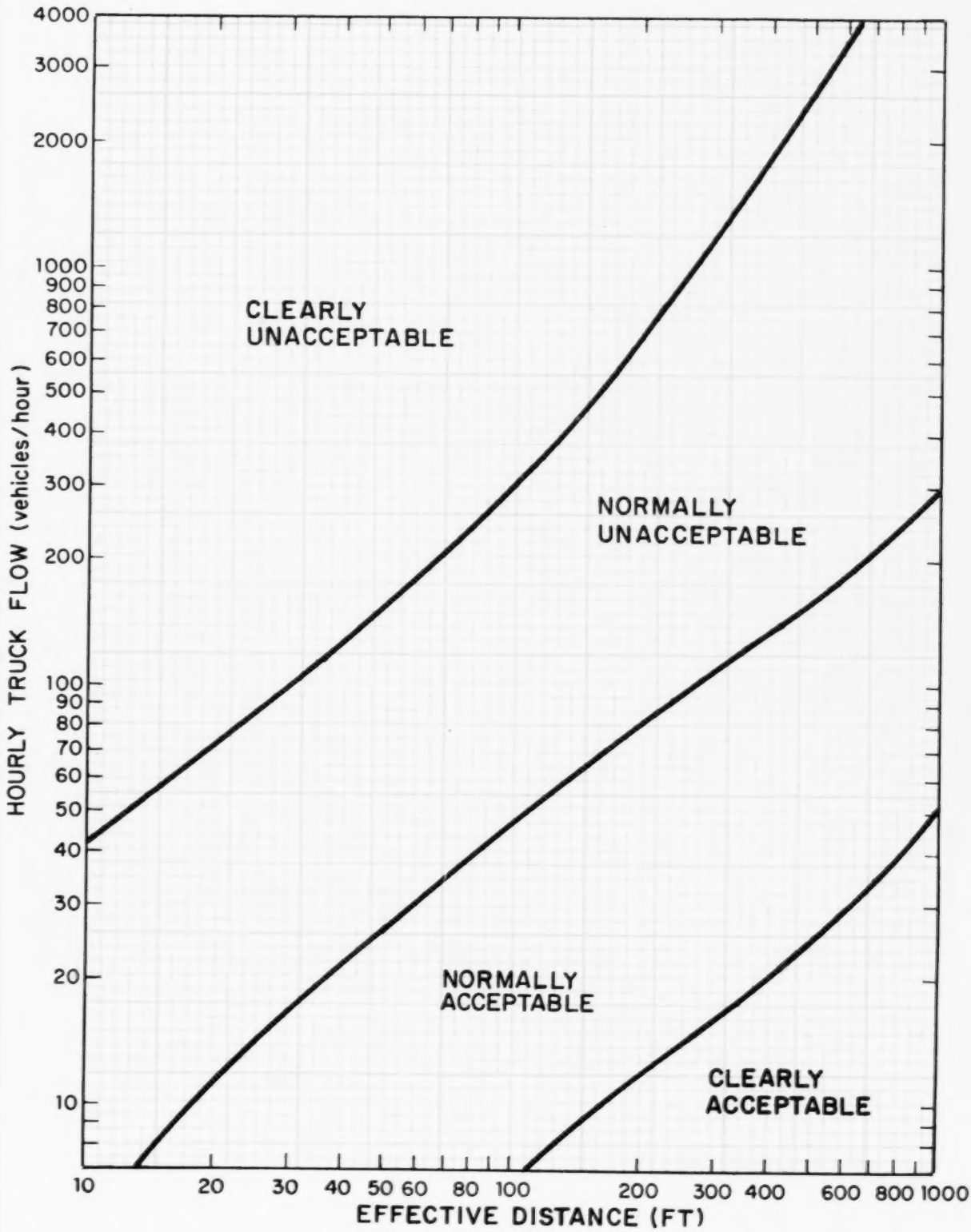


Figure 3.

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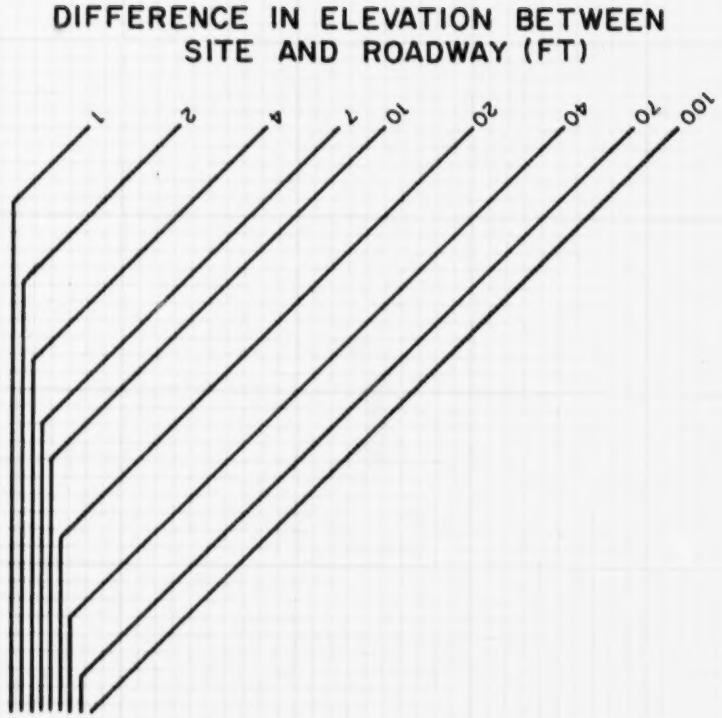
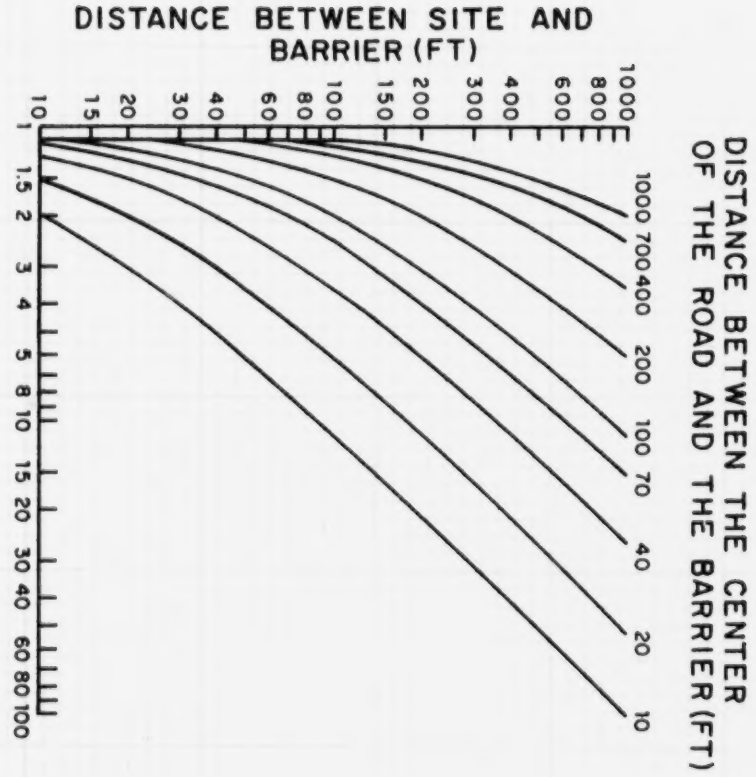
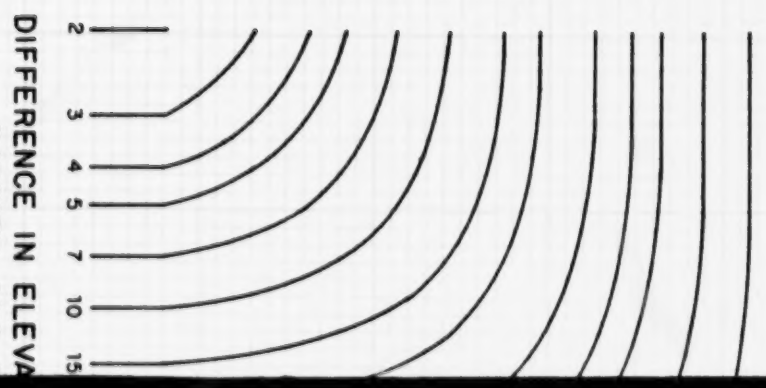
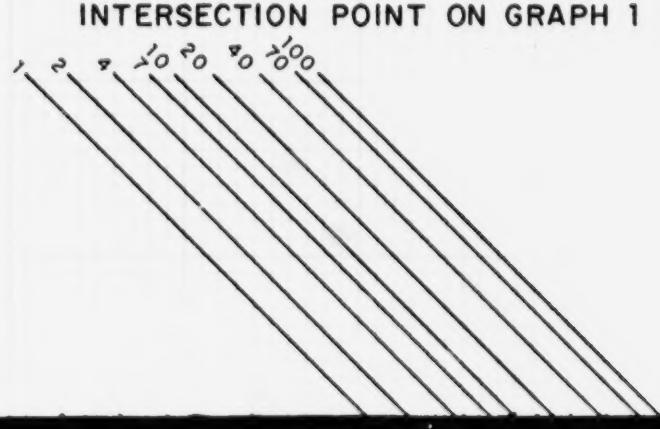

DIFFERENCE IN ELEVATION BETWEEN SITE AND ROADWAY (FT)
1
2
4
7
10
20
40
70
100


DISTANCE BETWEEN SITE AND BARRIER (FT)
10
15
20
30
40
60
80
100
150
200
300
400
600
800
1000
1
1.5
2
3
4
5
8
10
15
20
30
40
60
80
100
DISTANCE BETWEEN THE CENTER OF THE ROAD AND THE BARRIER (FT)
1000
700
400
200
100
70
40
20
10


DIFFERENCE IN ELEVA
BARRIER AND R
2
3
4
5
7
10
15


INTERSECTION POINT ON GRAPH 1
1
2
4
10
7
20
40
70
100

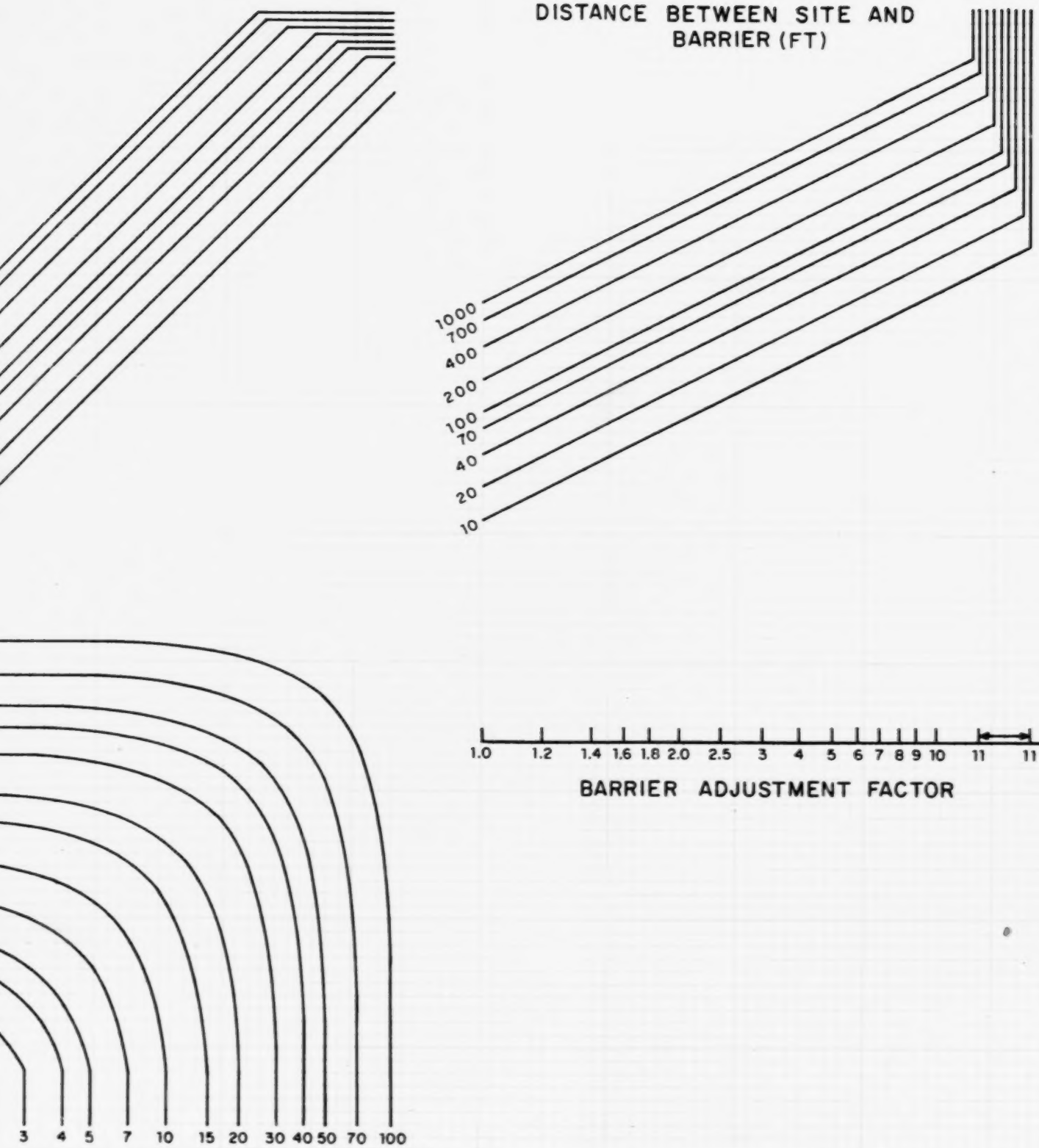

DISTANCE BETWEEN SITE AND BARRIER (FT)
1000
700
400
200
100
70
40
20
10
1.0
1.2
1.4
1.6
1.8
2.0
2.5
3
4
5
6
7
8
9
10
11
11
BARRIER ADJUSTMENT FACTOR
3
4
5
7
10
15
20
30
40
50
70
100
ERENCE IN ELEVATION BETWEEN BARRIER AND ROADWAY (FT)

Figure 4